

MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for July, 1897, is based on 2,864 reports from stations occupied by regular and voluntary observers, classified as follows: 144 from Weather Bureau stations; numerous special river stations; 33 from post surgeons, received through the Surgeon General, United States Army; 2,525 from voluntary observers; 96 received through the Southern Pacific Railway Company; 14 from Life-Saving stations, received through the Superintendent United States Life-Saving Service; 32 from Canadian stations; 20 from Mexican stations; 7 from Jamaica, W. I. International simultaneous observations are received from a few stations and used together with trustworthy newspaper extracts and special reports.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Meteorologist to the Government Survey, Honolulu; Dr. Mariano Bárcena, Director of the Central Meteorological Observatory of Mexico; Mr. Maxwell Hall, Government Meteorologist, Kingston, Jamaica; and Commander J. E. Craig, Hydrographer, United States Navy.

The REVIEW is prepared under the general editorial supervision of Prof. Cleveland Abbe. Unless otherwise specifically noted, the text is written by the Editor, but the meteorological tables contained in the last section are furnished by Mr. A. J. Henry, Chief of the Division of Records and Meteorological Data.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time, and, as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to generally conform to the modern international system of standard meridians, one hour apart, beginning with Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are generally corrected to agree with the eastern standard; otherwise, the local meridian is mentioned.

CLIMATOLOGY OF THE MONTH.

GENERAL CHARACTERISTICS.

The mean barometric pressure was, as usual in this month, low over the large region extending from Hudson Bay southwest to the head of the Gulf of California, but it was abnormally low especially in the Missouri and upper Mississippi valleys.

The mean temperature was decidedly below the normal in the Rocky Mountain Plateau Region, and above normal in the Lake Region, being respectively the lowest and highest on record at several stations in these districts. Precipitation over a small region in New Hampshire, Vermont, western Massachusetts and Connecticut, eastern New York and New Jersey was in remarkable excess, the unprecedented rainfall of 18 to 20 inches occurring in the center of this area; heavy rain also occurred in the Florida Peninsula and in Minnesota, reaching a maximum of 13 inches between Duluth and St. Paul.

ATMOSPHERIC PRESSURE.

[In inches and hundredths.]

The distribution of mean atmospheric pressure reduced to sea level, as shown by mercurial barometers, not reduced to standard gravity, and as determined from observations taken daily at 8 a. m. and 8 p. m. (seventy-fifth meridian time), is shown by isobars on Chart IV. That portion of the reduction

to standard gravity that depends on latitude is shown by the numbers printed on the right-hand border.

The *mean pressure* during the current month was highest over the Bermudas and almost equally high on the coast of Washington. It was lowest in Manitoba and Saskatchewan, and almost equally low in Arizona.

The highest reduced pressures were: In the United States, Tatoosh Island, 30.13; Fort Canby, 30.11; Portland, Oreg., Seattle, and Eureka, 30.08; Key West, 30.06; Tampa, Jupiter, and Charleston, 30.05. In Canada, Bermuda, 30.17; Halifax, 30.07; Yarmouth, 30.06; Sydney, 30.03. The lowest were: In the United States, Yuma and Phoenix, 29.76; Miles City, 29.81; Fresno, 29.82; Williston, Moorhead, and Pierre, 29.83. In Canada, Prince Albert, 29.72; Battleford and Winnipeg, 29.80; Medicine Hat and Qu'Appelle, 29.81; Minnedosa and Calgary, 29.83; Swift Current, 29.84.

As compared with the normal for July, the mean pressure was generally deficient in the Mississippi watershed, the South and Middle Atlantic States, and northward to the British Possessions. It was in excess throughout the Rocky Mountain Plateau Region, New England, and the Canadian Provinces.

The greatest excesses were: In the United States, Eastport, 0.09; Winnemucca, 0.08; Tatoosh Island, 0.06; Fort Canby, Baker City, Helena, Salt Lake City, and Denver, 0.05. In Canada, Halifax, 0.15; Yarmouth and Father Point, 0.13;

Sydney, 0.12; Chatham, 0.10. The deficits were: Omaha, 0.09; Miles City, Huron, Moorhead, St. Paul, Marquette, Davenport, 0.08. In Canada, Winnipeg, 0.09; Calgary, 0.07; Swift Current, 0.06; Qu'Appelle, White River, and Port Stanley, 0.05.

As compared with the preceding month of June, the pressures reduced to sea level show a decided rise in New England and the Canadian Provinces, Washington, Oregon, and in the Rocky Mountain Plateau Region, and on the eastern Slope. Elsewhere a slight fall is reported. The greatest rises were: Tatoosh Island, Fort Canby, El Paso, and Eastport, 0.11; Seattle, Portland, Oreg., Santa Fe, 0.09; Omaha, Nantucket, 0.07. In Canada, St. Johns, N. F., Halifax, Yarmouth, 0.14; Charlottetown, 0.13; Sydney, 0.12; Chatham and Father Point, 0.10. The greatest falls were: In the United States, Duluth, Marquette, Port Huron, Detroit, Sandusky, Cleveland, and Erie, 0.05. In Canada, Prince Albert, 0.08; Battleford, Winnipeg, Port. Arthur, White River, Port Stanley, 0.05.

AREAS OF HIGH AND LOW PRESSURE.

By Prof. H. A. HAZEN.

During the month there were but four highs sufficiently well defined to be charted, and eight lows. The tracks of these conditions will be found on Charts I and II. The accompanying table gives the principal facts regarding the origin and disappearance and apparent motion or translation of these conditions. As usual, during the summer season, both highs and lows have been ill defined and could be followed only with difficulty. As already noted in May and June, the highs appeared to be offshoots from the permanent high pressure in the Pacific. There was also a slight indication of a translation along the Pacific Coast from south to north before the advance into the country. The paths of all of the highs crossed the country from the north Pacific to the south Atlantic Coast. The general course of the lows was to the north of Montana, and nearly every track was along the north border of the country. Numbers II, V, VII, and VIII of the lows reached the north Atlantic Coast, but the other four vanished to the west of the Mississippi River and Great Lakes.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long W.	Length.	Duration.	Daily.	Hourly.
High areas.							<i>Miles.</i>	<i>Days.</i>	<i>Miles.</i>	<i>Miles.</i>
I.....	7, p. m.	47	128	12, a. m.	35	102	1,980	4.5	428	17.8
II.....	10, a. m.	53	102	14, a. m.	31	89	1,910	3.5	545	22.7
III.....	16, p. m.	46	128	23, p. m.	26	80	3,510	7.0	501	20.8
IV.....	24, p. m.	45	126	31, p. m.	31	78	3,520	7.0	503	21.0
Total.....							10,870	22.0	1,997	
Mean of 4 paths.....							2,717		494	20.6
Mean of 22.0 days.....									494	20.6
Low areas.										
I.....	1, a. m.	52	115	5, a. m.	51	94	1,420	4.0	355	14.8
II.....	5, p. m.	54	113	14, p. m.	49	88	4,540	9.0	504	20.9
III.....	12, a. m.	54	116	16, a. m.	40	85	2,410	4.0	602	25.1
IV.....	14, p. m.	51	116	18, a. m.	52	100	1,430	3.5	409	17.0
V.....	19, p. m.	50	114	25, a. m.	44	64	2,540	5.5	463	19.3
VI.....	21, a. m.	53	115	24, a. m.	41	96	1,260	3.0	420	17.5
VII.....	24, p. m.	53	103	30, p. m.	44	62	3,010	6.0	501	20.8
VIII.....	27, p. m.	52	111	*	43	63	2,980	5.5	488	20.3
Total.....							19,290	40.5	3,742	
Mean of 8 paths.....							2,411		468	19.5
Mean of 40.5 days.....									476	19.8

* August 2, a. m.

LOCAL STORMS.

By A. J. HENRY, Chief of Division of Records and Meteorological Data.

3d, 6th, 8th.—Unusually heavy rainfall, accompanied by winds of sufficient force in some cases to unroof buildings and prostrate frail structures, prevailed over portions of Minnesota and northern Wisconsin. It is estimated that the streets, parks, etc., in the city of Duluth were damaged by the rain and wind of the 3d to the extent of \$50,000.

On the 6th a tornado formed a short distance west of Lowery, Pope County, Minn. It traveled about 6 miles in a northeasterly direction in a path from 25 to 80 rods in width. Two persons were killed and 8 injured. Its approach was very generally observed and almost everyone had an opportunity to escape.

12th, 13th, 14th.—Many severe thunderstorms occurred on these dates throughout Michigan, Ohio, and eastward to the Atlantic. The winds on the coast from New Jersey to Maine were unusually severe for the season. Three lives were lost by drowning, and several small craft were wrecked.

22d.—A very severe thunderstorm and squall wind swept over Philadelphia and vicinity. Damages by hail, wind, and water were sustained in all parts of the city.

23d.—A violent thunderstorm experienced in New York on the afternoon of this date. Lightning struck in many places, including several of the high structures in the neighborhood of the City Hall. Beyond shattering the flagstuffs, but little damage was done.

30th.—A minor tornado was observed at 7 p. m., central time, near the town of San Jose, Ill. One house was destroyed and 6 of the inmates killed. Five other persons were injured. The path of the storm was quite narrow; its length could not be ascertained.

TEMPERATURE OF THE AIR.

[In degrees Fahrenheit.]

The mean temperatures and the departures from the normal, as determined from records of the maximum and minimum thermometers, are given in Table I for the regular stations of the Weather Bureau, which also gives the height of the thermometers above the ground at each station. The mean temperature is given for each station in Table II, for voluntary observers.

The monthly mean temperatures published in Table I, for the regular stations of the Weather Bureau, are the simple means of all the daily maxima and minima; for voluntary stations a variety of methods of computation is necessarily allowed, as shown by the notes appended to Table II. The mean temperatures given in Table III for Canadian stations are the simple means of 8 a. m. and 8 p. m. simultaneous observations.

The regular diurnal period in temperature is shown by the hourly means given in Table V for 29 stations selected out of 82 that maintain continuous thermograph records.

The distribution of the observed monthly mean temperature of the air over the United States and Canada is shown by the dotted isotherms on Chart IV; the lines are drawn over the Rocky Mountain Plateau region, although the temperatures have not been reduced to sea level, and the isotherms, therefore, relate to the average surface of the country occupied by our observers; such isotherms are controlled largely by the local topography, and should be drawn and studied in connection with a contour map.

The highest mean temperatures were: In the United States, Yuma, 91.1; Phoenix, 89.6; San Antonio, 85.0; Shreveport, 84.8; Palestine, 84.4; Galveston and Port Eads, 84.2. In Canada, Bermuda, 78.4; Toronto and Ottawa, 71.2; Parry Sound, Montreal, 70.6; Kingston, 70.2; Port Stanley, 70.1. The lowest were: In the United States, Point Reyes Light,